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ABSTRACT

This study explored the relationship of two distinctive types of divergent cognitive styles, "cold" creativity and "hot" creativity, to academic overachievement. The "cold" divergent cognitive style was found to be a controlled, problem-solving approach to stimuli, whereas the "hot" divergent cognitive style was a freer, more impulsive response to stimuli involving more emotion. The results show that the cold divergent variable of verbal originality is significantly characteristic of the overachieving group; however, the variables of fluency and flexibility do not differentiate the groups. There was no significant difference between the overachieving group and the normal achieving group on hot divergent cognitive style. Convergent abilities were found to have little predictive power for divergent abilities at any level. Data sheets are appended. (Author/LAA)

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DIVERGENT COGNITIVE STYLES IN ACADEMIC OVERACHIEVERS

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That differences in achievement can be attributed to varying personality characteristics other than cognitive variables has been widely assumed. The question arises as to whether there is indeed a cognitive variable involved which has been overlooked, although achievement is known to be basically dependent upon a subject's cognitive processes. Achievement potential has usually been predicted by group intelligence testing and reported as IQ scores. Standardized group intelligence tests have been found to be basically a measure of a convergent cognitive style. In the instances where a student's grade-point average exceeds what might be predicted from his IQ score, the behavior is considered in this paper as overachievement.

There have been many assumptions put forth to explain the overachieving student: as an error of measurement, a person with a high need for achievement, a teacher-centered student, etc., implying that overachievement is a function of emotional or "motivational" (as differentiated from cognitive) variables. Getzels and Jackson (1962:29) explored the possibility that overachievers, defined in their study as high creativity students, were motivated by a need for achievement. The McClelland need:achievement measure and Strodbeck's V-score were used with results indicating no difference in need for achievement between the high creativity students and high IQ students, nor was there a difference when compared with the general student population.

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Getzel et al (1962:36) also explored the relationship of teacher attitudes and values to the attitudes and values of the high creativity and high IQ students, concluding that the high IQ students were teacher oriented, but the high creativity students were not. The high IQ students valued and disvalued the same objects and ideals they believed their teachers did, the high creativity students did not; therefore, the overachievement was not attributed to a special kind of motivation such as "striving for good grades or success."

A creative person's intrinsic search to acquire information and his motivation for achievement may arise from the stimulation of successful learning which in operational form can appear as scholastic achievement. Guilford (1970:167) separates this from extrinsic motivation which manifests itself in the struggle for grades and pleasing others such as parents and teachers.

Since many students, as stated before, attain levels of achievement that are underestimated by the presently used measures of prediction, it is possible that their achievement involves cognitive variables not sampled in intelligence tests. Thus the possibility existed that divergent cognitive style may contribute to a level of scholastic performance not predicted by measures of convergent cognitive style, (IQ scores). Two divergent cognitive styles are considered as were postulated by Taft (1971). The two distinctive types of divergent cognitive style were termed "cold" creativity and "hot" creativity. The "cold" divergent cognitive style was found to be a controlled, problem-solving approach to stimuli, whereas the "hot" divergent cognitive style was a freer, more impulsive response to stimuli, at the same time, involving more emotion. The existence of these two styles would account for varying results in studies of the relationship of intelligence and creativity, as the problem-solving "cold" divergent cognitive style should be more likely to cross into the domain of intelligence test measures than would the impulsive "hot" divergent cognitive style.

The subject with "cold" cognitive style was more likely to use his imagination in service of his environmental demands and practice self-restraint in normal conditions. The subject with a "hot" divergent cognitive style yields to his impulses and fantasies and is less interested in coping in a calculated way with his environment. Both styles are alike in important qualities such as the use of intuition, and the ability to be unconventional. It is the mode of expression which differentiates the two styles.

In order to explore the phenomenon of overachievement in terms of cognitive variables, the following null hypotheses were formulated:

(1) Measures of cold divergent cognitive style will not differentiate the overachieving group from the normal achieving group.

(2) Measures of hot divergent cognitive style will not differentiate the two groups.

(3) The range of divergent cognitive scores is comparable at the various IQ levels.

(4) The correlation between convergent cognitive style scores, represented by IQ socres, and divergent cognitive style scores is not significant.

METHOD

Subjects:

Fifty subjects were selected, 25 served as an experimental group and 25 served as a control group. S's were selected from the senior class of a suburban high school. This age group was chosen because seniors have a well established achievement or nonachievement syndrome; also, creative acts as Barron (1963) has pointed out, are more likely to be the products of habitual systems of responding, and are well defined by the 12th grade. The 12th grade

population consisted of 239 students, but because of incomplete records, only 213 were used in regression data.

Assignment Design:

The selection procedure was designed to yield two groups of 25 students, each of whom would be equated for convergent cognitive ability, which was in the operational form of a Kuhlmann-Anderson Intelligence Test score. The correlation of .59 between the IQ scores and the grade-point averages of 213 seniors was significant beyond the .01 level for a two-tailed test. Individual student GPAs were then predicted on the basis of a regression formula and those students whose GPAs fell above their predicted ratios by at least one standard error of measurement were designated as overachievers. The Ss were contacted individually for participation in the study. Upon obtaining 25 students as Ss in the over-achieving group, the same number of Ss, with matching IQ scores and whose GPAs fell within one standard error of measurement of their predicted GPAs, were contacted for participation in the control group.

RESULTS

Group Comparison on Measures of Cold and Hot Divergent Cognitive Style:

The t-test was used to indicate whether hypotheses 1 and 2 would be accepted or rejected. The measures of cold divergent cognitive style are the fluency, flexibility, and originality scores on the Torrance Tests of Creative Thinking. The null hypothesis was accepted for the variables of fluency and flexibility. The t-test ratio for fluency was 0.00, indicating there is no significant difference between overachievers and normal achievers on the cognitive ability to produce divergent semantic units, the number of relevant responses produced in a limited time. The t ratio of 1.23 for flexibility indicated that there is not a

significant difference between the two groups on the cognitive ability to produce divergent semantic classes, shifts in thinking.

The null hypothesis was rejected for the cognitive variables of originality. The t ration of 1.81 indicated a difference between the overachievers and normal achievers, significant at the .05 level. This implies that the cognitive variable of originality distinguishes the overachievers from the normal achievers on the ability to produce divergent semantic transformations, remotely associated responses involving a mental leap from the obvious and common place.

Null hypothesis 2 was accepted for the hot divergent cognitive style. The t-ratio of 1.00 between the groups on the Barron Welsh Art Scale indicated a trend in the direction of the overachieving group, but it was not significant. The t-ratio of -0.80 for the What Kind of a Person Are You? screening device indicated no difference between the overachieving and normal achieving person.

The Range of Divergent Cognitive Scores at Three Levels of IQ:

Hypothesis 3 was accepted; the range of divergent cognitive scores is comparable at the various IQ levels. The spread of divergent cognitive scores was as diverse at the lower level of IQ as it was for the middle and upper levels. The research by Guilford (1967a:166-169, 1967b:9), Chambers (1969:790-791), and Barron (1969:42) had indicated that the scatter would be more diversified at higher levels of IQ, but more coalesced with IQ at the lower levels. This is true if IQ of 60 is used as lower limit rather than 85 which is the public school lower limit for regular classes.

The findings of this study indicate that a student with a high score on a divergent cognitive style measure was as likely to be found in the lower or middle IQ level as in the upper level. It can be assumed by virtue of the normal distribution concept, that more students are represented in the lower and middle IQ

levels, therefore, the residual of divergent cognitive style in the middle and lower IQ levels suggests an untapped potential even greater than at the upper level of IQ. Perhaps students who are not exceptional in either cognition, memory, or convergent thinking, use the divergent cognitive style in compensation and become more effective persons than would be possible with total dependence on the aforementioned convergent abilities. This spontaneous occurrence of a cognitive style without its recognition through rewards in the educational system, brings to focus the possibility for its utilization as a help in reinforcing the student with a lower level of IQ.

The Relationship Between Convergent Cognitive Scores and Divergent Cognitive Scores:

Hypothesis 4, that the correlation between convergent cognitive scores, represented by IQ scores would not be significant, was accepted. The data for Pearson r indicated only one definite but small relationship between the convergent scores and divergent scores, .38 was the low correlation between IQ scores and originality scores of the normal achievers. The Pearson r was .08 on this same measure of originality and IQ for the overachievers. The Pearson r for IQ scores and fluency scores was .06 for the overachievers and .26 for the normal achievers, the relationship being almost negligible. The same finding was true of the divergent cognitive ability of flexibility with IQ, the Pearson r was .12 for the normal achievers and .16 for the overachievers.

The Barron Welsh Art Scale, used as a measure of hot divergent cognitive style, dramatically indicated a definite but small negative relationship, -.33, between IQ scores and this hot divergent measure in the normal achieving group. The overachieving group Pearson r was .06 between IQ and the Barron Welsh Art Scale.

What Kind of a Person Are You? scores were found to have a low correlation of .36 with IQ for the overachieving group. The slight correlation of .10 between IQ was found for the normal achieving group. Again, as with the Barron Welsh Art Scale, the normal achiever correlation findings indicated less correlation between convergent abilities and their hot divergent abilities. Scholastic success, as predicted by convergent abilities, evidently does not indicate or depend on hot divergent cognitive abilities. The measure of convergent cognitive abilities does not have predictive power for divergent cognitive abilities.

CONCLUSIONS

Analysis of Two Divergent Cognitive Styles:

It is not surprising that the two groups were not different in measures of fluency, the ability to produce units of thought as it is a more primary cognitive ability in Guilford's conceptualization of intellectual abilities, and would be expected to be basic in both levels of achievement. The noticeable trend in the direction of the overachieving group, indicated that although flexibility, the ability to produce classes by shifts in thinking, also was a primary ability, it requires more intellectual energy than fluency.

The cognitive variable of originality, the transformation of previous units or classes of thought, involves a higher level of intellectual energy, and would be expected to occur less frequently in a general population, therefore, by chance, it would rarely occur so consistently in a group, unless that group was not typical of a normal population.

Although the null hypothesis was accepted for two variables, fluency and flexibility, it is felt that these abilities do not represent the intellectual energy of originality, and therefore are viewed as less descriptive measures of a

cold divergent cognitive style. They are considered as contributors to the style, but not as powerful independent measures of a divergent cognitive style. These levels of divergent intellectual energy are similar to the more primary mental operations of cognition and memory and the dependence upon these abilities for both convergent and divergent production operations.

The definite but small negative relationship between IQ and a hot divergent cognitive style, as measured by the Barron Welsh Art Scale, could be showing the implications of impulsivity. Delay function of the ego has been shown to be related to performance on intelligence tests (Spivack, Levine, and Springle, 1959), thus,the characteristic response style of a student with a hot divergent cognitive style would tend to serve as a hindrance in intelligence testing. The lower IQ score students were among the highest scorers on the Barron Welsh Art Scale. The ability to inhibit or delay plays an integral part in success or failure in testing as well as in scholastic work. The student with cold divergent cognitive style can inhibit or delay his responses, which enables him to be successful on testing and in scholastic endeavors.

The Range of Divergent Cognitive Scores at Various IQ Levels:

A high IQ score did not indicate the student's possibility of being highly creative. The high IQ scorers, in many cases, were the lowest scorers on measures of divergent cognitive style. This indicates the discrepancy between presently measured abilities and cognitive potential which has not been recognized.

The Relationship Between Convergent Cognitive Style and Divergent Cognitive Style:

The low relationship found in this study between convergent cognitive style and divergent cognitive style indicates that a student with divergent abilities, will have a minimal level of convergent abilities needed to function in regular classes of the public school. Divergent cognitive response depends on cognition

and memory abilities as does a convergent response, but beyond this minimal level, measured by intelligence tests, the divergent abilities cannot be predicted in relationship to the convergent abilities. The tests used in this study were measuring abilities not measured by the intelligence test.

The overachievers have found an avenue of expression for their cognitive style, but the reason for this exceptional achievement has remained open for exploration. This study has shown the aspect of cognitive functioning used by this group to be unmeasured by the intelligence test and to be, primarily, the cold divergent cognitive ability of verbal originality, the ability to transform semantic units and classes of thought.

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DATA

for

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By

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CG 008 101

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TABLE II

COMPARISON OF OVERACHIEVERS AND NORMAL ACHIEVERS ON TESTS OF DIVERGENT COGNITIVE STYLE

	No.	Mean	Standard Deviation	Variance	t-ratio
TTCT Fluency					
Overachievers	25	35.44	8.42	73.84	0.00
Normal Achievers	25	35.44	10.35	111.59	
TTCT Flexibility					
Overachievers	25	23.08	4.83	24.33	1.23
Normal Achievers	25	21.72	4.14	17.88	
TTCT Originality					
Overachievers	25	33.60	16.43	269.92	1.81*
Normal Achievers	25	25.52	11.46	131.29	
Barron Welsh Art Scale					
Overachievers	25	34.40	13.13	172.33	1.00
Normal Achievers	25	30.60	13.68	187.16	
What Kind of a Person Are You?					
Overachievers	25	26.36	5.34	29.74	-0.80
Normal Achievers	25	27.76	5.27	28.94	

*Significant at .05 df = 24

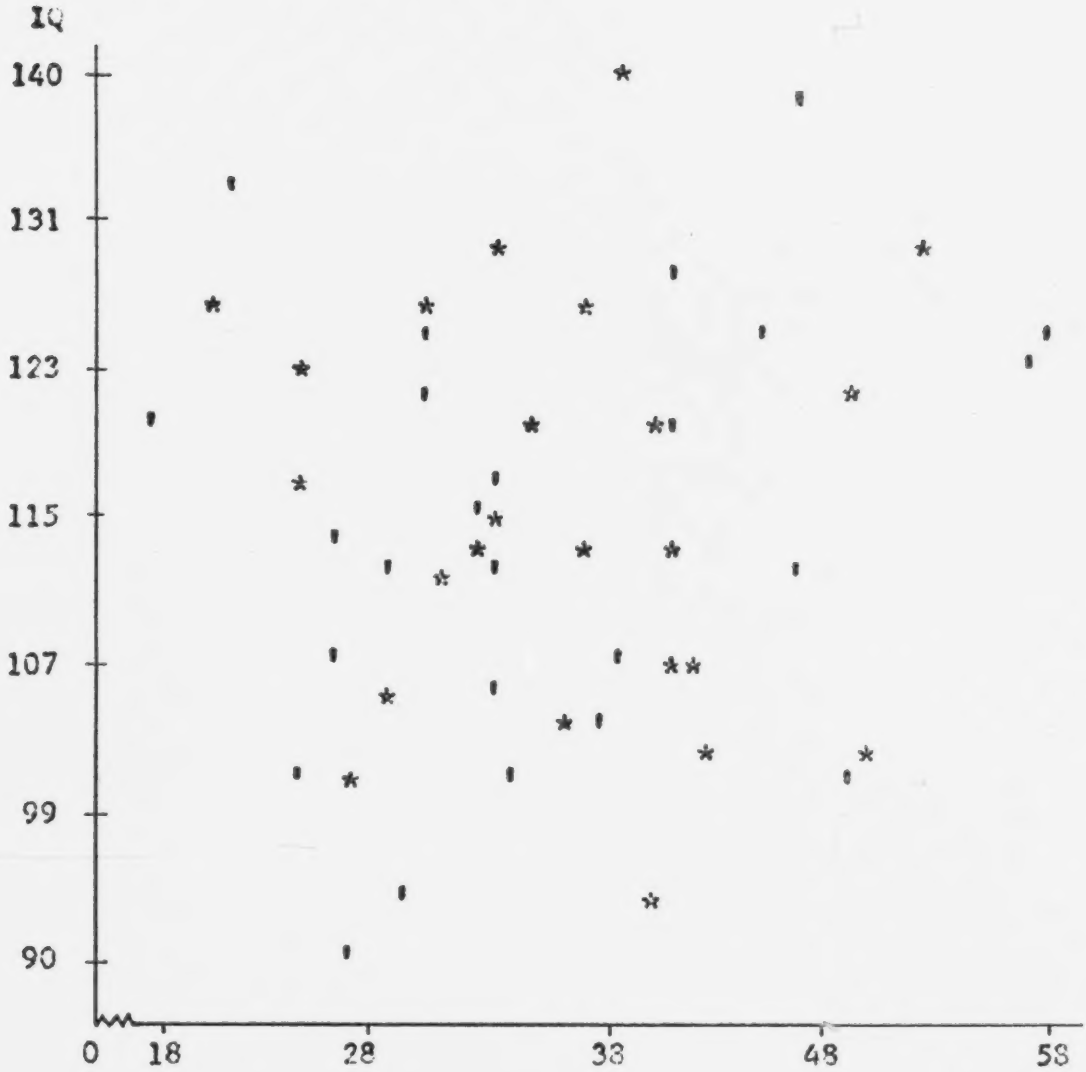


FIGURE 1

THE RANGE OF FLUENCY SCORES AT VARIOUS IQ LEVELS

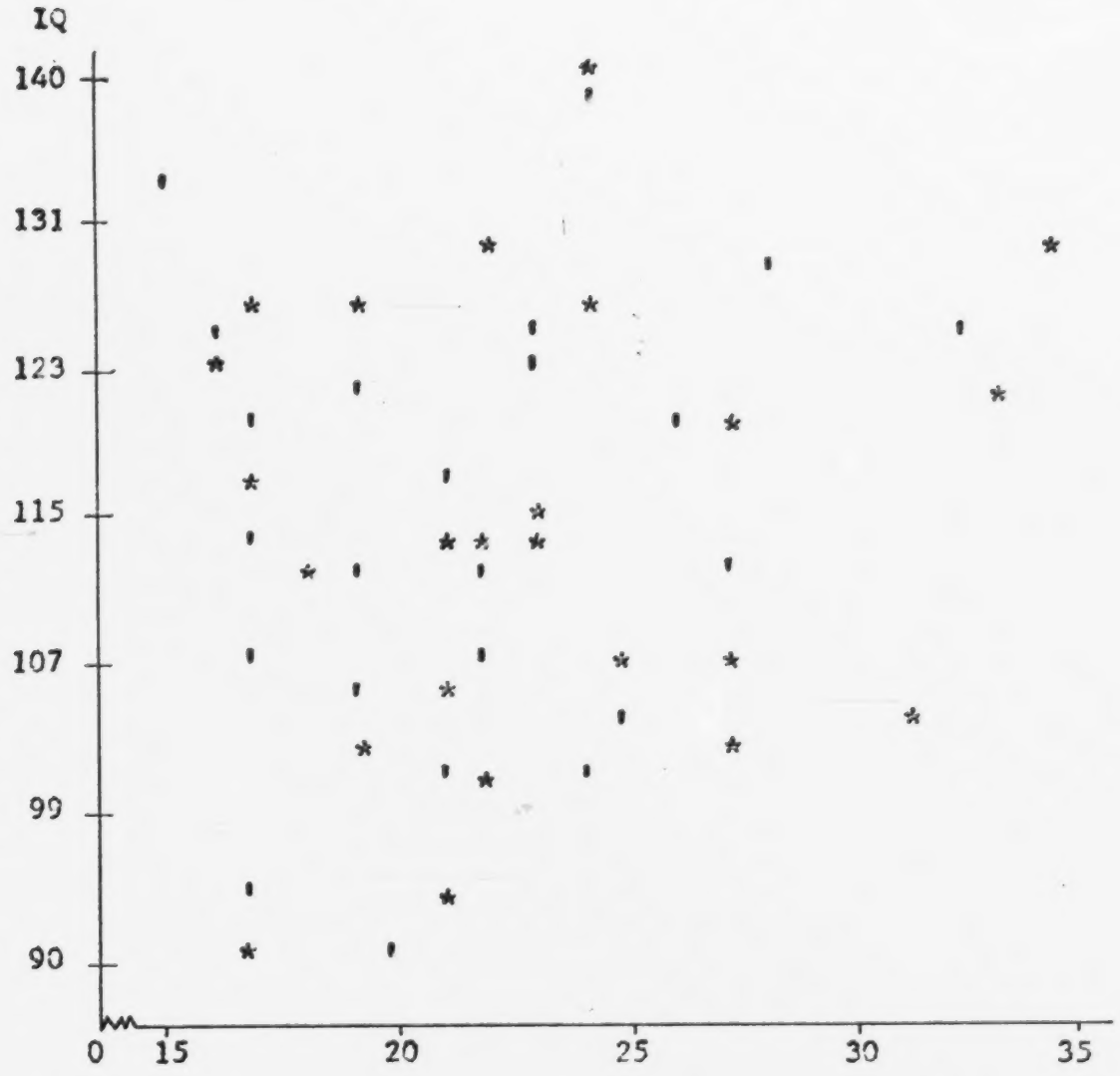
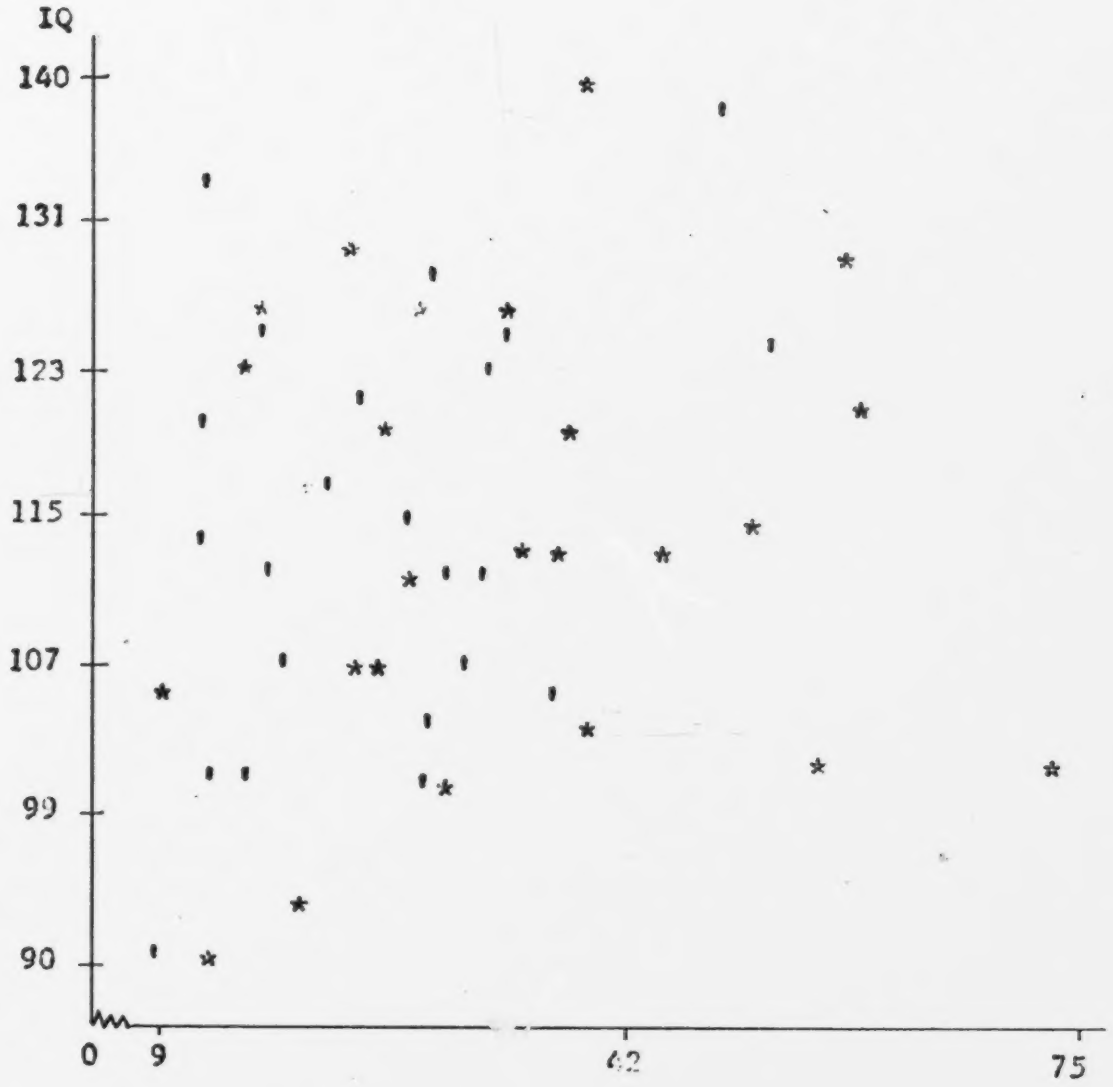


FIGURE 2

THE RANGE OF FLEXIBILITY SCORES AT VARIOUS IQ LEVELS



Torrance Tests of Creative Thinking--
Originality Scores

' = Normal-achieving group
* = Over-achieving group

FIGURE 3

THE RANGE OF ORIGINALITY SCORES AT VARIOUS IQ LEVELS

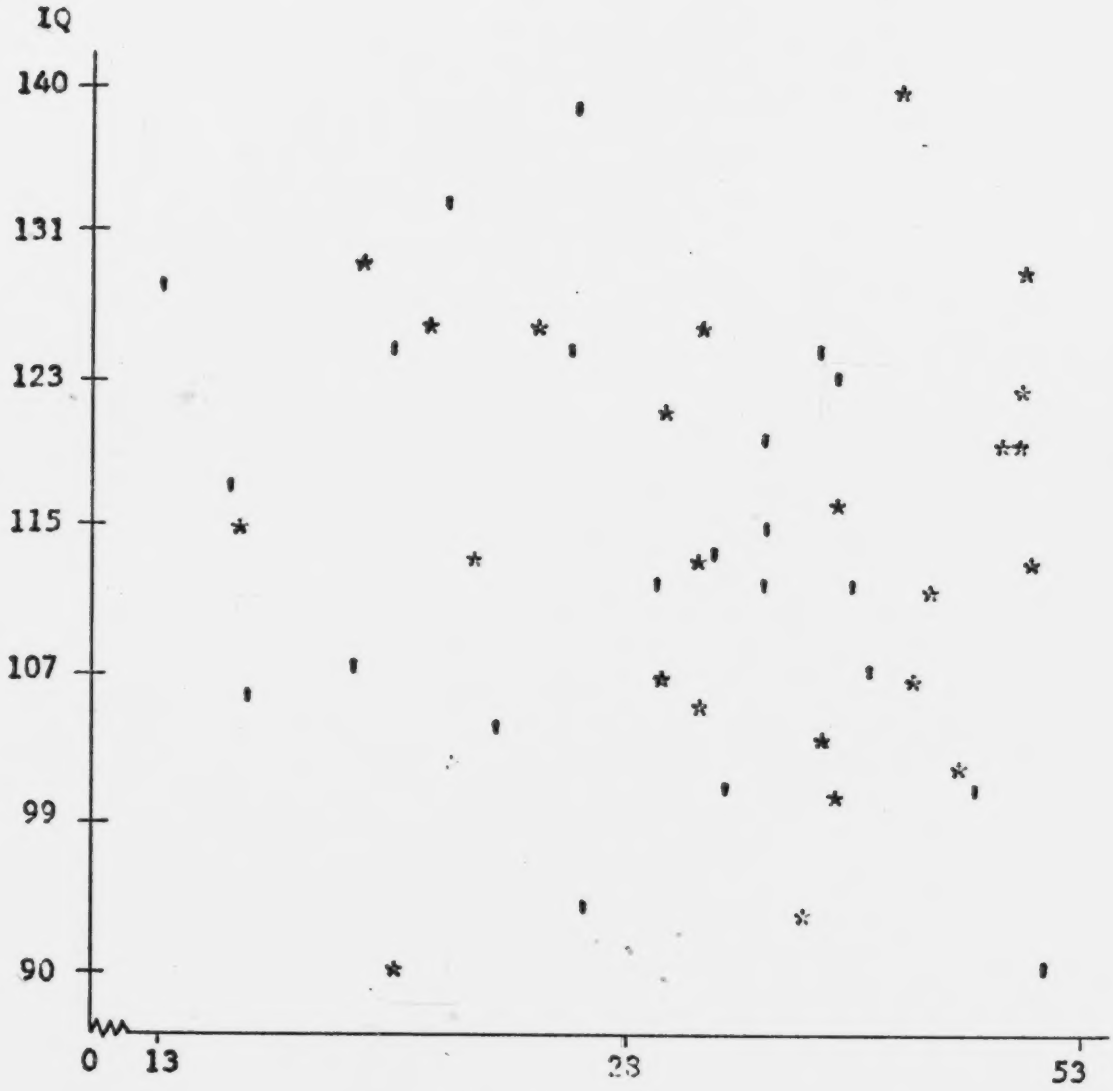


FIGURE 4

THE RANGE OF SCORES ON THE BARRON WELSH ART SCALE AT VARIOUS IQ LEVELS

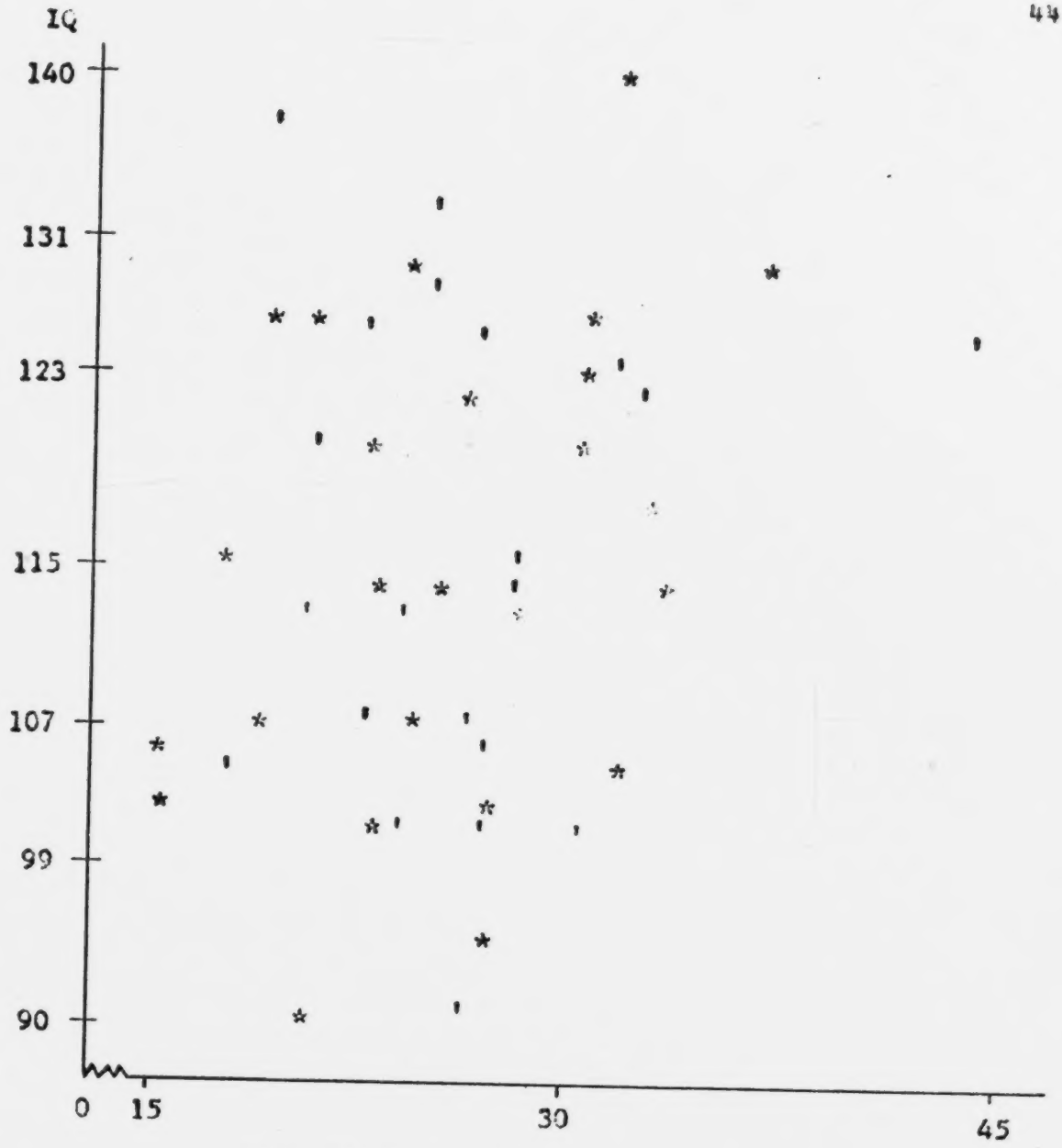


FIGURE 5

THE RANGE OF SCORES ON THE TORRANCE SCREENING DEVICE AT VARIOUS IQ LEVELS

TABLE III

THE RANGE OF DIVERGENT COGNITIVE STYLE SCORES AT THREE IQ LEVELS

IQ Level	TTCT Fluency		TTCT Flexibility		TTCT Originality		Barron Welsh Art Scale		What Kind of a Person Are You?	
	Low	High	Low	High	Low	High	Low	High	Low	High
Upper 124-140	20	58	15	34	11	59	3	50	21	44
Middle 108-123	18	57	16	33	11	60	7	51	19	37
Lower 90-107	20	50	17	31	9	74	8	52	17	32

TABLE IV

THE PEARSON PRODUCT-MOMENT CORRELATION BETWEEN CONVERGENT COGNITIVE SCORES AND DIVERGENT COGNITIVE SCORES

Divergent	Convergent Kuhlman-Anderson Intelligence Test	t-ratio
TTCT Fluency		
Overachievers	.06	0.29
Normal Achievers	.26	1.30
TTCT Flexibility		
Overachievers	.16	0.78
Normal Achievers	.12	0.58
TTCT Originality		
Overachievers	.08	0.38
Normal Achievers	.38	1.98
Barron Welsh Art Scale		
Overachievers	.06	0.29
Normal Achievers	-.33	-1.68
What Kind of a Person Are You?		
Overachievers	.36	1.85
Normal Achievers	.10	0.48